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(54) Moulded plastic handle and method of its manufacture

(57) A moulded plastic handle and a method of its manufacture, the handle comprising an injection-moulded, rigid, thermoplastic core 11 having an outer sleeve 12 of similar but softer thermoplastic polymer injection-moulded to its surface. A central domed rectangular cavity 13 is formed axially in the core 11 for receiving a similarly shaped tang (23, Fig. 4) of a tool. Preferably the tang is of pressed metal, is of an inverted U-shape, has saw-tooth or ratchet form teeth (24, Fig. 4) on its lower edges and is force-fit in cavity 13.

The core 11 is of a shaped, non-cylindrical form and has protrusions in the form of ribs 17a, 17b near its front end 15 and further protrusions in the form of bosses 18a, 18b formed around a transverse hole 14 near its rear end. The combination of the external shape of core 11 and the aforesaid protrusions serving to further inhibit any tendency for the sleeve 12 to twist on core 11 when the tool is in use.

The method includes the use of two separate sets of injection moulding dies with a number of distinct stages. Core 11 is moulded in a first stage and sleeve 12 moulded around it in a second stage.

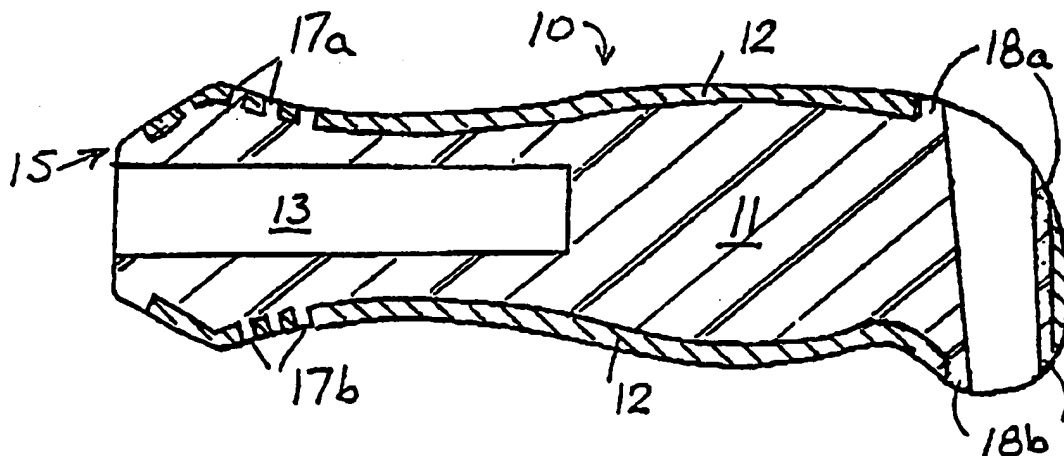


FIGURE 2

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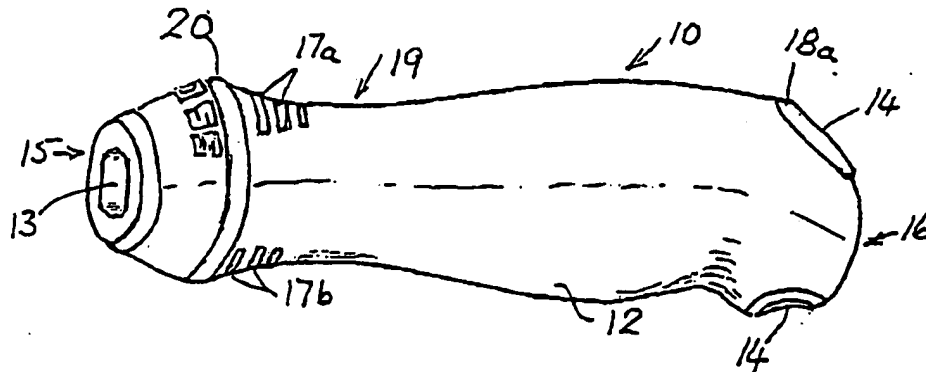


FIGURE 1

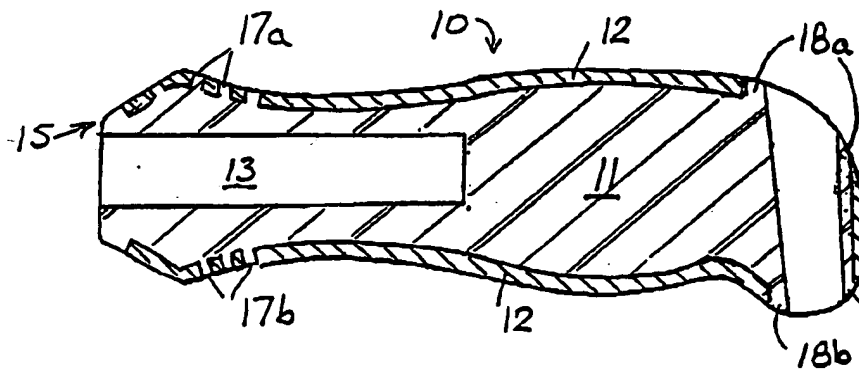


FIGURE 2

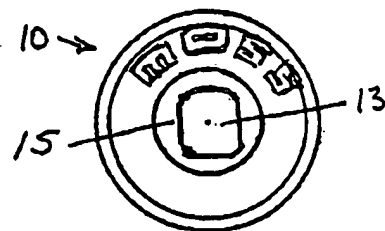


FIGURE 3

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FIGURE 4

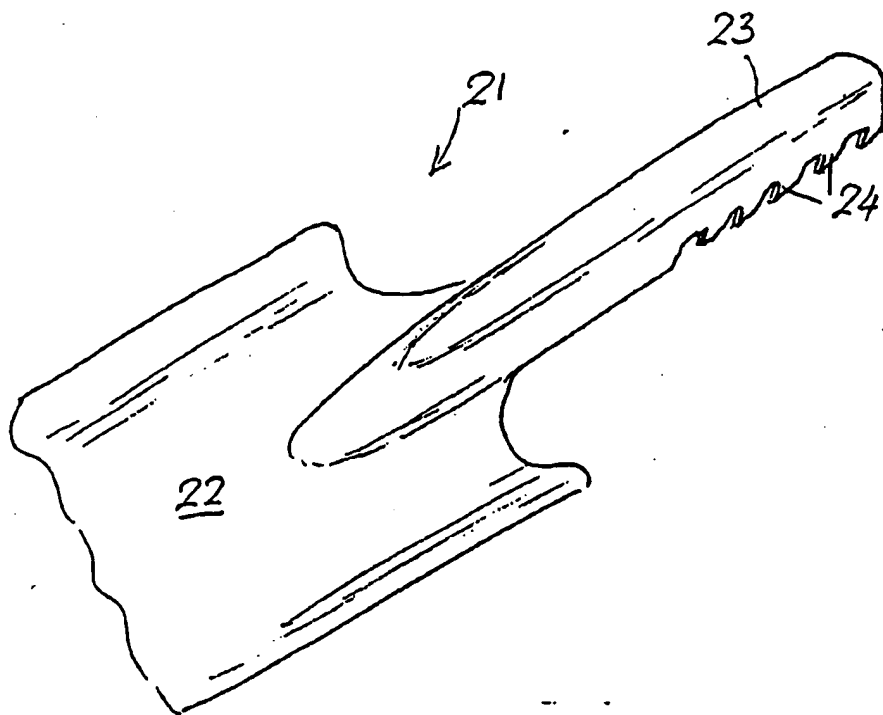
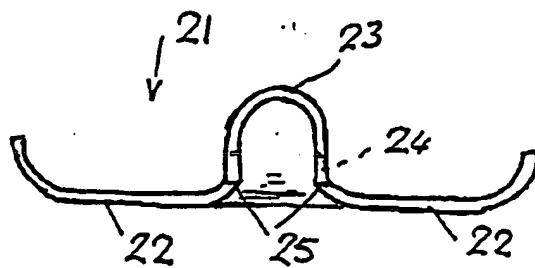


FIGURE 5



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TECHNICAL FIELD

This invention relates to moulded plastic handles or hafts for use with hand-tools. It is also concerned with methods of forming such handles or hafts and with hand-tools employing them.

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The invention is particularly suitable for small gardening tools such as trowels and weeders, for plasters and painter's putty-knives, broad-knives and scrapers, and for a variety of work-shop hand-tools. However, the handles and hafts of this invention may also be used on sporting equipment or toys such as bats and projectile
10 launchers and receivers, or such as the handle-bars of scooters, tricycles, bikes and the like.

For convenience, therefore, the term 'tool' will be used herein to include sporting equipment fitted with hand-grips as well as the broad range of hand-tools indicated
15 above. The term 'haft' will be used to designate the moulded hand-grip applied to the tool. Unless the context indicates otherwise, the term 'complete tool' will be used to designate a hafted tool. That part of the tool which enters the haft will be termed the 'tang' and the working or active part of the tool (which is integral with or attached to the tang) will be termed the 'blade', even though this term may not be normally
20 applied to handle-bars, to rasps and files, the prongs of forks, to spikes, spoons, scoops and other specialised non-cutting-tools of the garden, household and workshop. Finally, the tool-end of the haft will be termed the front or forward end and the opposite end of the haft will be termed the rear or back end.

25 BACKGROUND TO THE INVENTION

Moulded plastic hafts for hand-tools are well known and most commonly involve injection-moulding a thermoplastic or thermosetting material onto the tang of the tool. This requires the injection-moulding dies to be constructed so as to accurately locate the particular blade and tang employed. This usually requires the blades to be
30 carefully loaded by hand into the hot injection-moulding dies, thereby greatly reducing production capacity. Thus, even though the same haft moulding might be used for many different tools, many different forms of injection-moulding tooling may be required to accommodate the different tangs and blades. Furthermore, to ensure adequate strength, the haft is generally moulded from hard and rigid plastic material,

even though such materials cause blisters and discomfort to the users of the finished tools.

An alternative approach to the hafting of tools in plastic, also well known in the art, is to pre-mould standard hafts from thermoplastic resins and to then force the heated tangs of tools into them in a separate operation. But this technique usually also requires the hand-loading of hot work into machines and the use of hard plastics and, almost always, produces a markedly inferior tang-to-haft bond.

While it is known to bond pads of soft materials to the plastic hafts of hand-tools to make them more comfortable to use, such pads tend to lift, twist or peel off, or to slip on the haft during use. Often the adhesive bond between the pad and the haft is weakened by common solvents and oils.

15 OBJECTIVE OF THE INVENTION

It is the objective of the invention to provide plastic hafts for hand-tools, hand-tools employing such hafts, and methods of manufacturing such hafts which will overcome or ameliorate one or more of the above-mentioned problems with known plastic-hafted hand-tools and methods of forming the same.

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OUTLINE OF INVENTION

From one aspect, the invention comprises a haft for a hand-tool or the like having:

- an elongate core injection-moulded from a tough and hard but non-brittle synthetic thermoplastic polymeric material (such as polypropylene),
- 25 • an axially-extending cavity in the front end of the core for receiving the tang of a tool, and
- a sleeve of rubber-like, deformable, resilient or flexible polymeric material injection-moulded onto the core.

30 From another aspect, the invention comprises a method of manufacturing a haft for a tool, including the steps of:

- injection-moulding an elongate core of a tough and hard but non-brittle synthetic thermoplastic polymeric material (such as polypropylene) having an axial cavity for accommodating the tang of a tool extending rearward from its front end, and
- injection-moulding onto the outer surface of the core a sleeve of similar but
5 softer polymeric so that the material of the sleeve is heat-bonded to the material of the core.

The moulding process preferably involves two steps using two different dies, one for moulding the core and the other for moulding a sleeve onto a core placed in the die,
10 the core being transferred from the first die to the second for the forming of the sleeve thereon. Alternatively, the same die may be used for both operations, provided inserts of the same form as the sleeve are used in the die when moulding the core but removed when moulding the sleeve.

- 15 Preferably, the sleeve is formed from substantially the same polymeric material as the core but the material of the sleeve is formulated to include a minor proportion of plasticisers or of softer copolymers to provide the desired rubber-like resilience. The use of the same basic polymeric material for the sleeve ensures integral heat-induced bonding between the sleeve and the core during the injection-moulding of the sleeve
20 onto the core.

Preferably, the cavity in the core for the tang of a tool is of non-circular section, though it may be ovoid, having curved top and bottom surfaces. In one form, it may be of generally rectangular section but having a domed top. A domed cavity having
25 generally rectilinear side walls is well suited, according to another aspect of this invention, for the accommodation of an inverted U-section pressed-metal tang, preferably having ratchet-form teeth on its edges. Such a tang can be pressed into the cavity and held securely therein without the use of heat. Tangs of this type can be formed on a wide variety of tools and can be readily fitted with hafts using
30 simple automated or semi-automated machinery.

Preferably, also, the core (and therefore the sleeve) has a curved longitudinal profile and is of a non-circular section so that the likelihood of the sleeve moving or twisting

on the core is further reduced. Hafts shaped in this way also fit more comfortably in the hand. Furthermore, it is preferable (also to minimise relative movement between the sleeve and the core) to form radial protrusions on the core at either or both ends thereof which extend through the thickness of the sleeve material. A protrusion near the front of the haft may conveniently form a raised thumb-knob on the top of the haft, while two opposing protrusions may be formed near the rear to accommodate a transverse hole or passage in the core which may be conveniently used for hanging the hand-tool. Again, at least the thumb-knob protrusion(s) can be designed to further enhance the ergonomic properties of the haft.

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DESCRIPTION OF EXAMPLES

Having broadly portrayed the nature of the present invention, a particular example will now be described by way of illustration only. In the following description, reference will be made to the accompanying drawings in which:

15

Figure 1 is a perspective view of the haft of the chosen example,

Figure 2 is a side sectional elevation of the haft of Figure 1,

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Figure 3 is a front end elevation of the haft of Figures 1 and 2,

Figure 4 is a perspective view of the tang end of a gardening trowel adapted to fit the haft of Figures 1-3, and

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Figure 5 is an end elevation of the tang of the trowel of Figure 4.

Referring particularly to Figures 1 and 2, the haft 10 of the chosen example comprises a rigid, elongate polypropylene core 11 having a soft-feel plasticised or rubberised polypropylene sleeve 12 moulded around it. The core has a longitudinal cavity 13 and transverse hole 14 formed therein. Cavity 13 extends axially and rearward from the front face 15 of the core and is for accommodating the tang of a tool. Transverse hole 14 is formed at or near the rear end 16 of the haft 10 so that the finished tool can be conveniently hung on a hook or pin (not shown). As will be

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best seen from Figure 3, cavity 13 is of a flat-sided, domed section having a slightly curved base or bottom.

Sleeve 12 of this example is moulded to almost completely cover core 11 leaving only a few parts of the core exposed; these being the front end face 15, sets of upper and lower ribs 17 and 17b near the front end of the haft, and upper and lower bosses 18a and 18b (formed around the upper and lower ends of transverse hole 14) at the rear and of the haft. The ribs 17a and 17b and the bosses 18a and 18b therefore form protrusions of the core material through the sleeve and assist in locating the sleeve 10 on the core. This function is also assisted by the curved, non-cylindrical form of the haft (which, of course, is also advantageous in forming a comfortable grip). Preferably (as shown), the section of the haft first becomes narrower and then wider, (moving from the rear to the front) so that a neck 19 and a head or collar 20 is formed near front end 15, ribs 17a being formed on the upper surface of neck 19 near 15 (or partially upon) head 20 so as to form a thumb grip or nob.

The method of this example by which the haft of Figures 1-3 is formed, preferably involves two separate sets of injection-moulding dies and a number of distinct stages. In the first stage, the core 11 is moulded using, for example, polypropylene Grade 20 KMT6100 obtained from Shell Chemicals in a first set of dies. The moulded core is then removed from the die and trimmed of flashing and spigots if necessary. In the next stage, the core is located by its tang-cavity 13 and (if desired) by hole 14 in a second set of dies having a larger cavity with the outer profile of sleeve 12. The second set of dies is then heated as normal and the sleeve is injection-moulded 25 around the core (except for those areas or protrusions of the core which abut the mould and are therefore left exposed by the sleeve). The sleeve material may be, for example, a polypropylene-based thermoplastic rubber such Santoprene 211-55 obtainable from Elastomer Systems. Under the heat and pressure of the second injection-moulding step, the sleeve material is intimately and integrally heat-bonded 30 to the surface of the core material.

Referring now to Figures 4 and 5, the tool of this example comprises a gardening hand-trowel 21 which is stamped and pressed from a single piece of stainless-steel

sheet. The blade 22 of trowel 21 is of conventional form and is integral with the tang 23 which is of an inverted U-shape and is formed with a series of saw-tooth or ratchet-form teeth 24 on each of the lower rear side-edges 25 thereof. Tang 23 is formed with a rounded or domed upper face and a section that closely matches that 5 of hole 13 in haft 10. It is however, sized to be a force-fit in hole 13 so that side-edges 25 are deflected inwards by the walls of hole 13 and so that contact between the domed top of tang 23 and the similarly shaped domed top of cavity 13 causes teeth 24 to bite into the outer edges of the base, or floor 26 (Figure 3) of cavity 13. In so doing, the sides of tang 23 are resiliently deflected together, also assisting the 10 grip of the tang in its cavity. With such a configuration of tang and cavity, a firm lifetime frictional grip between the tool and its haft can be readily obtained.

It will be appreciated that the example of the invention described above meets the objectives set out above and avoids the problems of the prior art outlined in the 15 beginning of this specification. However, those skilled in the art will also understand that many variations and modifications can be made to the example as disclosed without departing from the spirit and scope of this invention as defined by the following claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

- 1 A haft for a hand-tool or the like comprising:
 - an elongate core formed by injection-moulding from a tough and hard but non-brittle synthetic thermoplastic polymeric material,
- 5 • an axially-extending cavity moulded in said core and opening into the front end thereof for receiving the tang of a tool, and
 - a sleeve of soft-feel, rubber-like and resilient thermoplastic material formed by injection-moulding said sleeve material onto or around the core.
- 10 2 A haft according to claim 1 wherein:
 - said sleeve is formed from substantially the same thermoplastic material as the core but modified to be more rubber-like, deformable and resilient, and
 - the sleeve is heat-bonded to the core by during the injection moulding of the sleeve on or around the core.
- 15 3 A haft according to claim 1 or 2 wherein:
 - the surface of the core is curved both longitudinally and transversely so as to depart from a cylindrical form, and
 - at least one radially-extending protrusion is formed on the surface of the core
- 20 which extends fully or substantially through the sleeve (after the sleeve is moulded onto the core),

so as to counter any tendency of the sleeve to twist on the core when the haft is in use.
- 25 4 A haft according to claim 3 wherein,
 - a protrusion is formed on the upper side of the core near the front end thereof to form a raised, hard thumb-knob or stop on the top of the haft.
- 5 A haft according to claim 3 or 4 wherein,
 - 30 • a transverse hole is formed through the core near the rear end thereof having a boss of core material formed around at least one of its openings, said boss forming one of said protrusions.

6 A haft according to any preceding claim, wherein:

- said cavity in the core for the tang of a tool is of a domed rectangular section so as to be adapted to accommodate an inverted U-section pressed-metal tang.

5 7 A hand-tool fitted with a haft as claimed in any one of the preceding claims, having:

- a blade fitted with a pressed metal tang force-fitted into said cavity, said tang having an inverted U-shape cross-section, and
 - saw-tooth or ratchet-form teeth formed in the edges of the tang to grip the
- 10 corresponding surfaces of the wall of the cavity.

8 A method of manufacturing a haft for a hand-tool, including the steps of:

- injection-moulding an elongate core of a tough and hard but non-brittle synthetic thermoplastic polymeric material having an axial cavity for accommodating the
- 15 tang of a tool extending rearward from its front end, and
- injection-moulding onto the outer surface of the core a sleeve of similar but softer polymeric so that the material of the sleeve is heat-bonded to the material of the core.

20 9 A method according to claim 8 including the steps of:

- Injection moulding the core in a first set of injection-moulding dies,
 - removing the core from said first set of dies,
 - locating the core in a second set of injection-moulding dies having a cavity substantially larger than the core over a first area or areas thereof, but closely
- 25 fitting the core over a second area or areas thereof,
- injection moulding said softer polymeric material onto said core to form said sleeve on the said first area or areas thereof.

10. A haft for a hand-tool, substantially as hereinbefore described with reference to, and as illustrated in, the

30 accompanying drawings.

11. A method of manufacturing a haft for a hand-tool, substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9401556.7

- 9 -

Relevant Technical Fields	Search Examiner H F YOUNG
(i) UK Cl (Ed.M) B4K (KAC, KAG, KCA, KCB, KCK, KCN, KJS) B5A (AT14M, AT14P, AB18)	Date of completion of Search 22 MARCH 1994
(ii) Int Cl (Ed.5) B25G (1/00,10; 3/14) B29C (45/16)	Documents considered relevant following a search in respect of Claims :- 1-11
Databases (see below)	
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.	
(ii)	

Categories of documents

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| <p>X: Document indicating lack of novelty or of inventive step.</p> <p>Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.</p> <p>A: Document indicating technological background and/or state of the art.</p> | <p>P: Document published on or after the declared priority date but before the filing date of the present application.</p> <p>E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.</p> <p>&: Member of the same patent family: corresponding document.</p> |
|--|---|

Category	Identity of document and relevant passages	Relevant to claim(s)
X,P	GB 2264062 A (PALEY) 18 August 1993 see whole document and note Figure 6	1,2,8,9
X	GB 1142073 (CARLTON) see Figure 3 and lines 108-128 of page 2	1
X	EP 0208942 A2 (WERNER) see Figures 4-6	1

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